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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/021,683	11/28/2001	Russell A. Wincheski	LAR 16116-1	9204
23351	7590	07/21/2004	EXAMINER	
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LANGLEY RESEARCH CENTER 3 LANGLEY BOULEVARD MAIL STOP 212 HAMPTON, VA 236812199			KINDER, DARRELL D	
			ART UNIT	PAPER NUMBER
			2862	

DATE MAILED: 07/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

A

<b>Office Action Summary</b>	<b>Application No.</b> 10/021,683	<b>Applicant(s)</b> WINCHESKI ET AL.	
	<b>Examiner</b> Darrell Kinder	<b>Art Unit</b> 2862	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 09 April 2004.  
 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.  
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-8 and 10-36 is/are pending in the application.  
     4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) ☒ Claim(s) 1-4, 6-8, 10-21 and 24-36 is/are allowed.  
 6) ☒ Claim(s) 22 and 23 is/are rejected.  
 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
 10) ☒ The drawing(s) filed on 28 November 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
     a) ☐ All    b) ☐ Some \* c) ☐ None of:  
         1. ☐ Certified copies of the priority documents have been received.  
         2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
         3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to because in Figures 1-20, the lines and letters and the figures are not uniformly clear, etc. see Form PTO-948 mailed on 10 October 2003. Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

Art Unit: 2862

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
2. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent no. 5,648,721 ("Wincheski") in view of U.S. Patent no. 6,150,809 ("Tiernan").

Regarding claim 22, Wincheski discloses an eddy current device highly resistant to lift off conditions for nondestructive evaluation of electrically conductive material comprising a plurality of flux focusing eddy current probes and additionally comprising a casing (**Fig. 8A**; col. 7 lines 54-60).

Wincheski does not disclose that the probes are giant magnetoresistive probes.

Tiernan teaches that the use of GMR sensors in NDE evaluation is superior to existing eddy current technology due to its excellent signal to noise ratio, high spatial resolution and depth profiling (col. 9 lines 8-11).

One of ordinary skill in the art would have looked to the teachings of Tiernan to modify Wincheski as they are both in NDE, and by incorporating the teachings contained in Tiernan, one of ordinary skill in the art could gain some of the benefits associated with the use of GMR sensors and probes which use GMR sensors.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Wincheski such that the plurality of probes within a casing were GMR probes, as taught by Tiernan, as it would provide a more efficient and accurate sensor.

3. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wincheski in view of Tiernan and Hüscherlath et al. U.S. Patent no. 4,792,755 ("Hüscherlath").

Referring to claim 23, Wincheski discloses an excitation coil (**Fig. 1 11**) for inducing eddy currents within the electrically conductive material (16), the excitation coil having windings wherein the excitation coil's longitudinal axis is perpendicular to the surface of the electrically conductive material; a plurality of magnetic sensors (**Fig. 8B 73A, 73B**) each surrounded by the windings of the excitation coil (11); a flux focusing lens (12) disposed between the excitation coil and the sensor, composed of a conductive material having a high magnetic permeability, having a closed end opening opposite the surface of the electrically conductive material and having an opening adjacent to the surface of the electrically conductive material and which prevents magnetic coupling between the excitation coil and the sensor and which produces high flux density at the outer edge of the sensor (col. 10 lines 47-58).

Wincheski discloses a pickup coil as the sensor (col. 5 lines 65-67), and hence does not disclose the use of a giant magnetoresistive sensor. The tubular flux-focusing lens of Wincheski has one closed end, instead of two openings. Furthermore, Wincheski

Art Unit: 2862

does not disclose the use of a feedback coil used to for canceling leakage magnetic fields.

Tiernan discloses a giant magnetoresistive sensor for nondestructive evaluation wherein the sensor comprises a GMR sensor instead of a pickup coil, and the use of two open ends of a tubular flux-focusing device. Tiernan teaches the benefits of using a giant magnetoresistive sensor to sense magnetic fields as they provide excellent signal to noise ratio, high spatial resolution and depth profiling (col. 9 lines 8-11). Tiernan further teaches the use of a feedback coil positioned adjacent to the giant magnetoresistive sensor along the longitudinal axis thereof and surrounded by the windings of the excitation coil and the flux-focusing lens (**Fig. 1b**; col. 9 lines 57-58) as it prevents large applied fields from damaging the GMR sensor by generating a compensation field (col. 11 lines 34-41). This prior art first teaches that a GMR sensor is an improvement, and then further teaches that the use of a feedback coil alleviates problems of the GMR, providing an even further benefit.

Tiernan does not disclose that the feedback coils are used to compensate leakage magnetic fields. However it is well known to cancel out stray leakage magnetic fields when performing nondestructive evaluation, as the leakage fields will decrease the ability of the sensor to resolve structural faults. Tiernan could further modify the feedback coil and system such that it can cancel out stray magnetic fields, while still protecting the GMR sensor from large applied fields.

Furthermore, Hüscherlath discloses a device for nondestructive evaluation of a workpiece wherein it is taught that stray leakage fields should be compensated as they can result in poor evaluation of the workpiece (col. 1 lines 26-47, 63-65).

One of ordinary skill in the art would have been motivated to modify the probe of Wincheski with the teachings of Tiernan, and replaced the pickup coils as the sensors with GMR sensors, as it is a more efficient and accurate sensor. Furthermore, to take full advantage of the improved magnetic sensor, the GMR sensors, one of ordinary skill in the art would have incorporated feedback coils to protect the GMR sensors from any large applied fields, and to cancel stray leakage flux to improve the resolution of detecting defects when performing nondestructive evaluation, as taught by Hüscherlath. The argument for the replacement of one pickup coil for one GMR sensor and feedback coil pair can be extended to a plurality of magnetic sensors or pickup coils.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the embodiment with a plurality of magnetic sensors of Wincheski with the teachings of Tiernan and Hüscherlath such that the pickup coils of Wincheski are replaced with GMR sensors to enhance efficiency and performance, and further enhanced in combination with the addition of feedback coils and second open end of a flux focusing lens, as it would greatly improve the ability to perform nondestructive evaluation on electrically conductive materials.

***Allowable Subject Matter***

4. Claims 1-4, 6-8, 10-21 and 24-36 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: the prior art does not disclose or fairly suggest a device and method for performing non-destructive evaluation comprising an excitation coil for inducing eddy currents, a giant magnetoresistive sensor surrounded by the windings of the excitation coil, and a feedback coil which receives a feedback current from a feedback source having the same frequency as an excitation frequency as the excitation frequency but 190 degrees out of phase with the output of the GMR sensor to cancel leakage magnetic fields, in combination with the rest of the elements of the claims.

#### ***Response to Arguments***

5. Applicant's arguments with respect to claim 23 have been considered but are moot in view of the new ground(s) of rejection.
6. The affidavits under 37 CFR 1.132 filed 9 April 2004 are sufficient to overcome the rejection of claims 1-36 based upon Wincheski et al. "Deep Flaw Detection With Giant Magnetoresistive (GMR) Based Self-Nulling Probe," *26<sup>th</sup> Annual Review of Progress in QNDE*, Montreal, Canada, July 1999.

#### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within



Art Unit: 2862

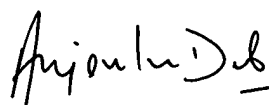
TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Darrell Kinder whose telephone number is 571- 272-2264. The examiner can normally be reached on Monday-Friday 7:00-4:30, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, N. Le can be reached on 571-272-2233. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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**ANJAN DEB**  
**PRIMARY EXAMINER**